

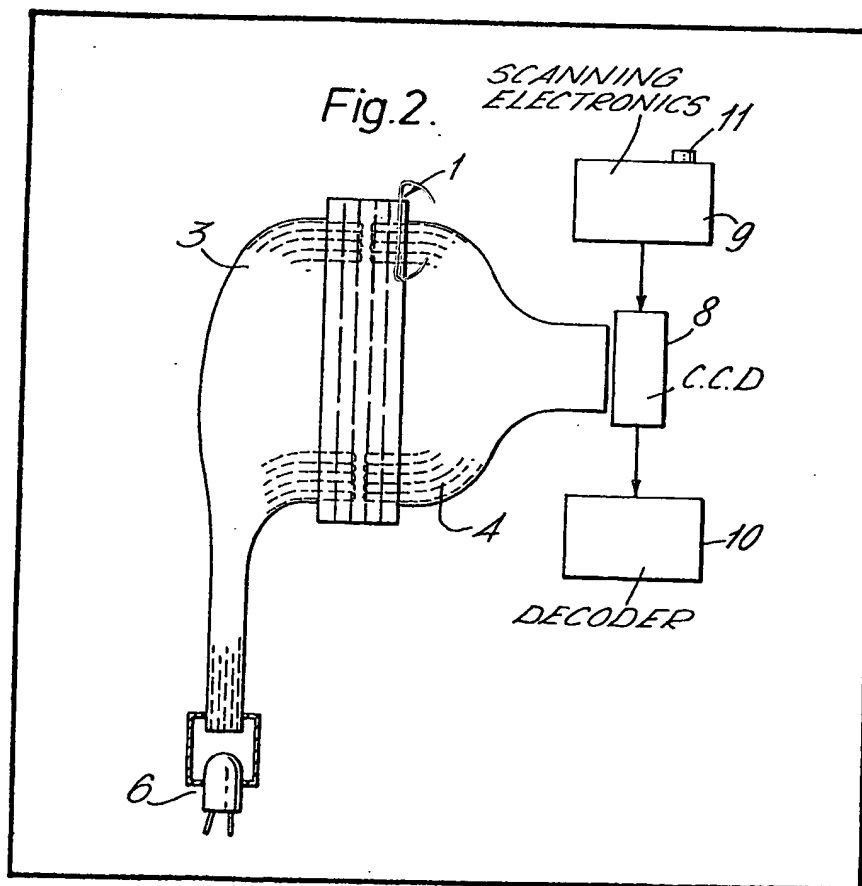
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## (54) Bar code reader

(57) A static bar code reader consists of a reading head formed by a moulding (3), which carries a set of optical fibres (4) arranged in a straight line. This head is placed over the code to be read and light reflected from that code, which is "modulated" in accordance with that code is conveyed via the fibres to electronic reading circuitry. This latter may include CCD's whose outputs are

scanned and the scanned result applied to a decoder. The moulding is preferably transparent to facilitate head location. Light supply to the head is either ambient light, light from a source conveyed to the head via another set of optical fibres, or light from a linear lamp in the head. For reading telephone numbers from a directory the head has an extension portion of cylindrical lens form which is placed over the line of print associated with the bar code.



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Fig. 1.

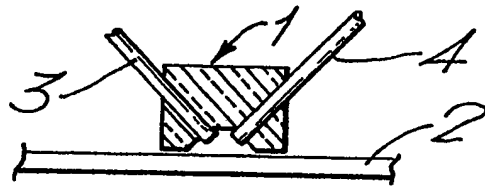


Fig. 2.

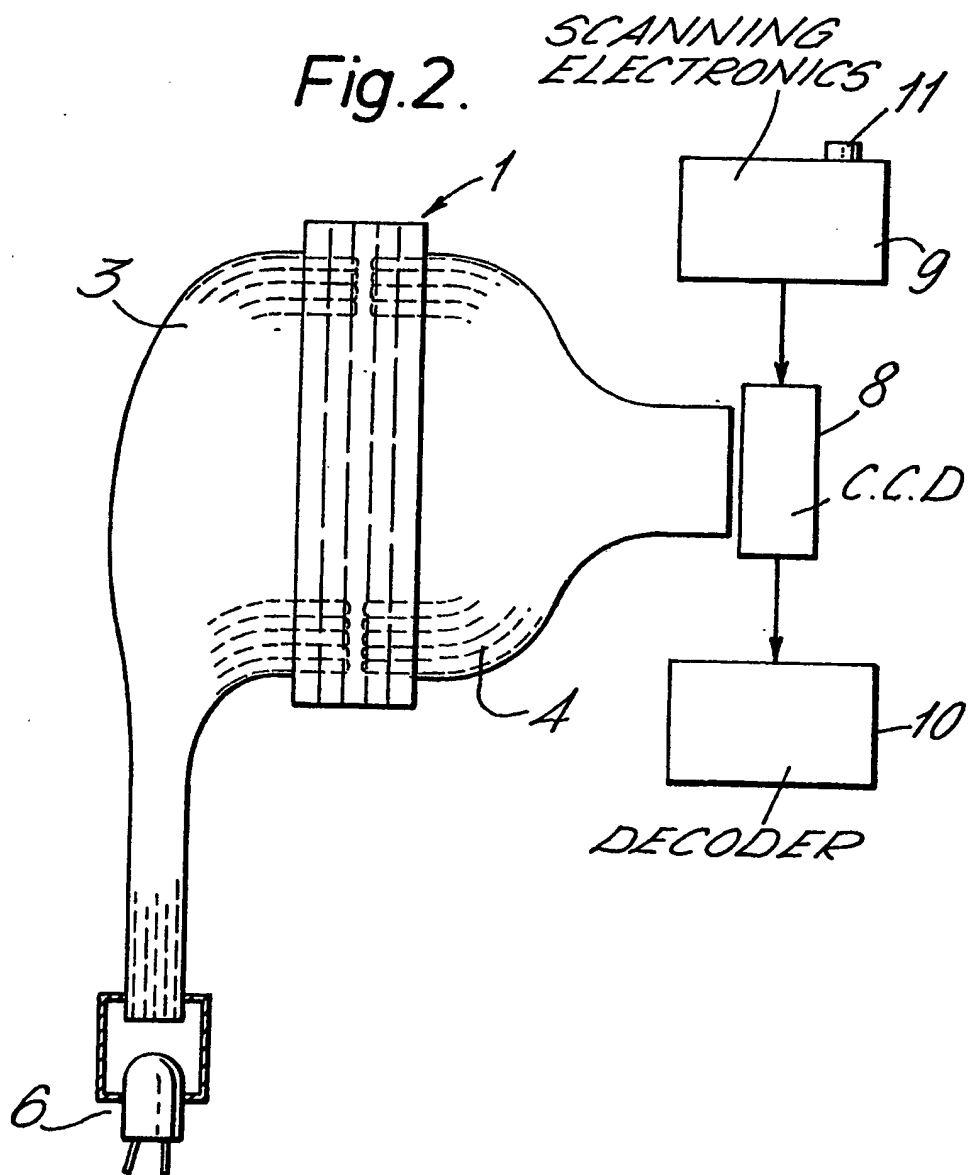


Fig.3.

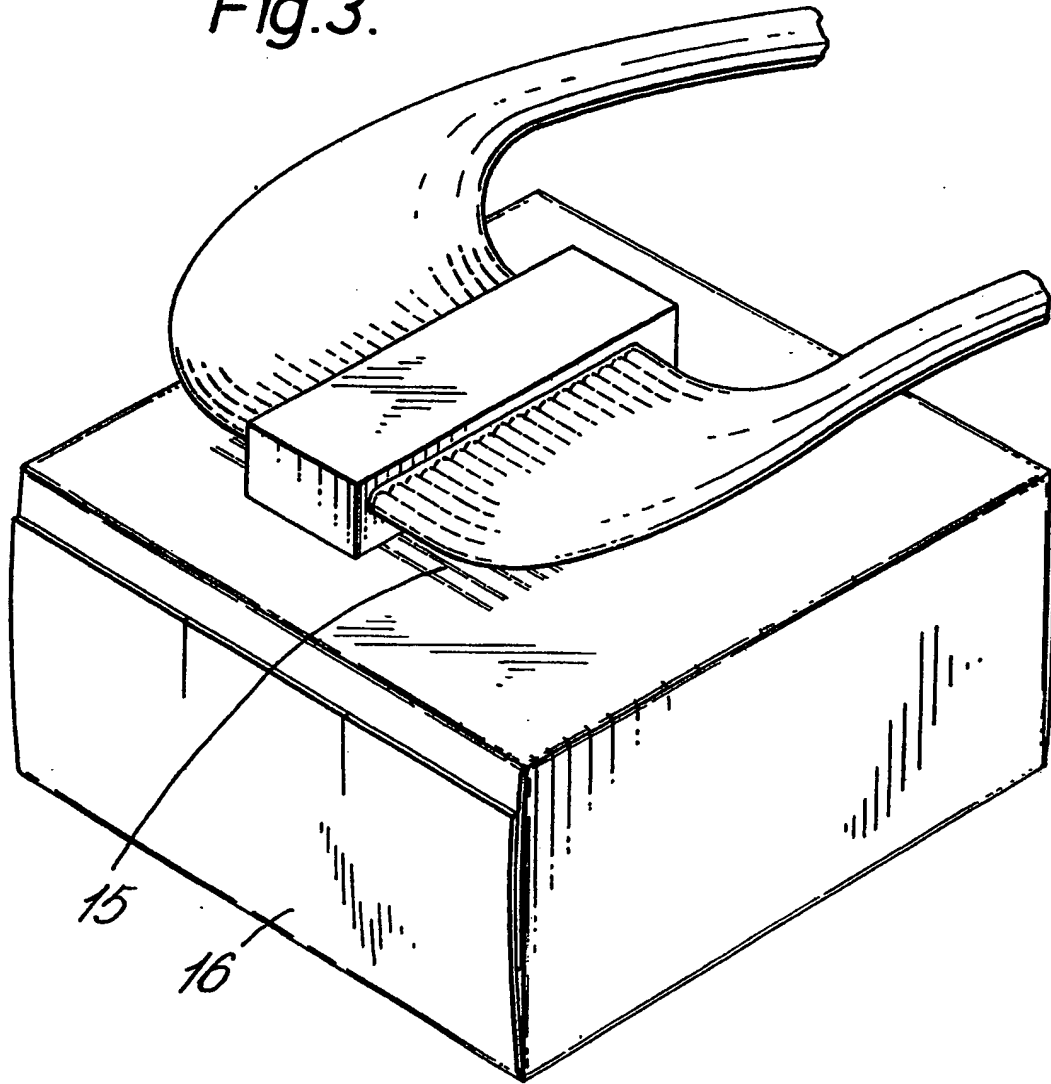


Fig.4.

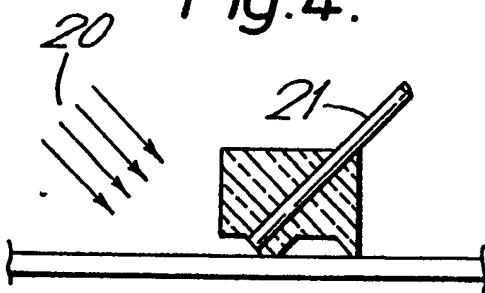
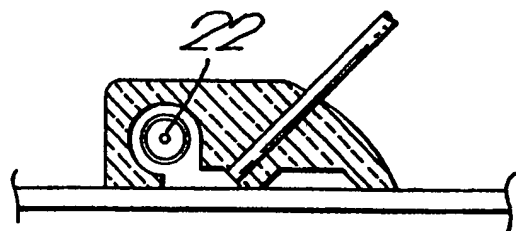


Fig.5.



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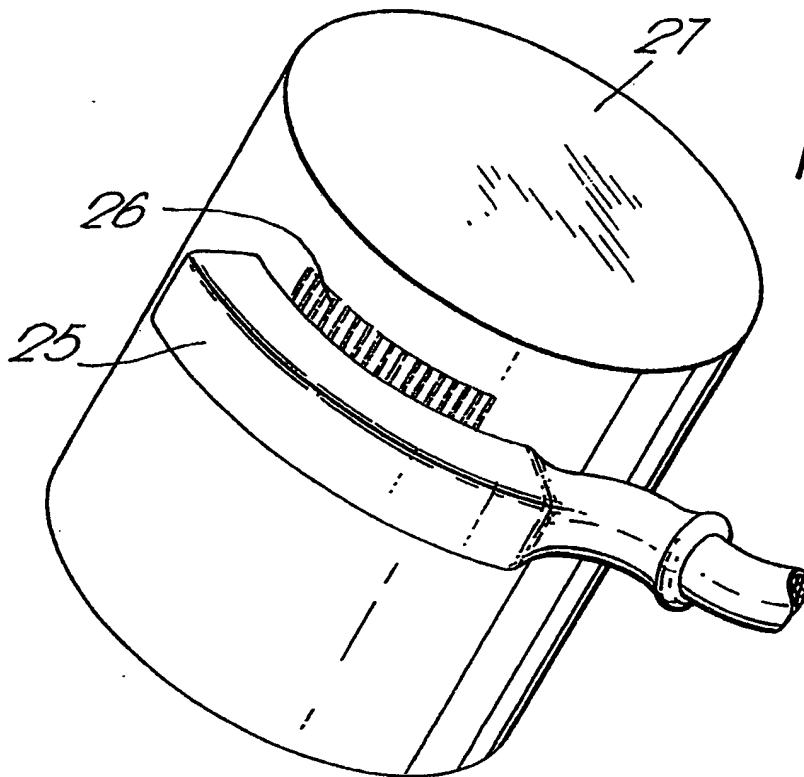


Fig. 6.

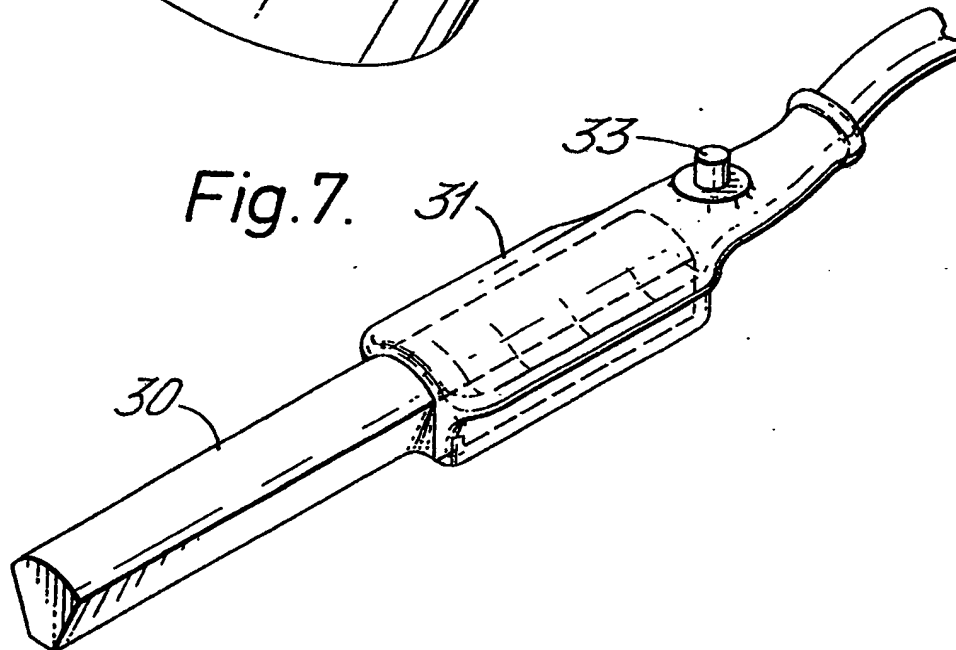


Fig. 7.

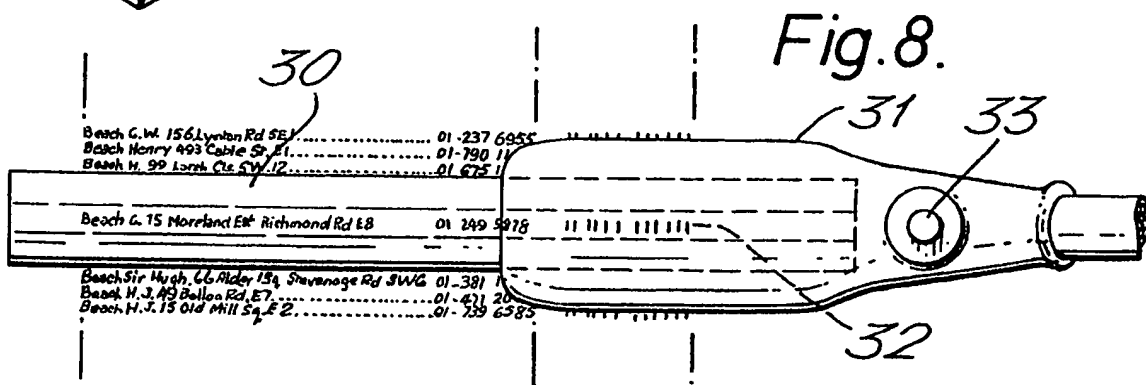


Fig. 8.

# **SPECIFICATION** **Bar code reader**

This invention relates to bar code readers.

Bar codes are coming more and more into use, especially on food products as sold in super-markets, although it will be appreciated that bar codes are of much wider application. Hence it is an object of this invention to enable the production of cheap and simple bar code readers.

According to the invention there is provided an optical bar code reader, which includes a reading head housing an array of optical fibres whose ends are in a linear array which when in use is placed adjacent to and aligned with the length of a bar code to be read, electronic devices each responsive to light reflected from the bar code being read, and a scanning circuit associated with said electronic devices and adapted when energized to cause the conditions of said electronic devices, and thus the bar code with which the fibre ends are aligned, to be read.

Such a reader is a static device in that it is placed over the code to be read and switched on, whereafter the electronic circuiting causes the bar code to be scanned. This is by contrast with many known code readers, which have to be moved or wiped along the length of the bar code. Thus the novel code readers do not cause wear to the surface on which the code is printed, which is significant in such applications as the reading of bar code representations of telephone numbers.

Embodiments of the invention will now be described with reference to the accompanying drawings, in which

Fig. 1 shows the basic element of a first bar code reader embodying the invention

Fig. 2 shows schematically the arrangement of such a code reader

Fig. 3 shows how such a code reader is used

Figures 4 and 5 are representations similar to Fig. 1 of further embodiments of the invention

Fig. 6 shows a bar code reader embodying the invention for reading from a curved surface

Figs. 7 and 8 show a bar code reader embodying the invention and specially adapted for reading a bar code representation of a telephone number.

In Fig. 1 is a part section of one element of a bar code reader, and it includes a moulding 1 which is placed close to or in actual contact with a surface 2 on which a bar code to be read is printed. This moulding 1 contains an array of optical fibres such as 3 via which light is supplied to the code to be read and another array of fibres such as 4 via which light is conveyed to the electronics for reading the code. The light as conveyed to the electronics is thus "modulated" in accordance with the code to be read.

The moulded block 1 which carries the two sets of optical fibres is preferably of transparent material, e.g. a polymerized methyl methacrylate plastics, so that the user can see the bar code through the block. Thus he can see to locate the reader correctly before reading occurs.

Fig. 2 shows the overall arrangement of the reader, which includes a lamp or light emitting diode 6 from which light is fed via the "supply" fibres 3 to one side of the reader head, i.e. the moulding 1. The output fibres 4 extend to the electronics, which in this case includes an array of charge coupled devices 8 which connect the light patterns reflected from the code being read into an electrical form. Associated with this is scanning electronics 9 and a decoder 10.

To read the code the user positions the head formed by the moulding 1 over the code and when satisfied that it is correctly located, presses a button 11, which energizes the scanning electronics 9 as a result of which the code is read and the result applied to the decoder 10, which gives an output identifying the code read.

The pitch of the fibres in the reading head is close enough that finely spaced code lines are accurately read. The pitch of the output fibres at the CCD block 8 is as small as each other, perhaps with the fibres touching each other, so that as many as possible can be encompassed by the CCD's.

Fig. 3 shows how the reader is used. It is placed on the bar code 15 as printed on the carton (or the like) 16 so that the full length of the code is under the reading head. The read push-button (or equivalent) is operated to cause the CCD elements to scan the array of fibres from end to end, probably a number of times in a fraction of a second, so that the decoding circuitry can perform checks on the read-out. This circuitry, as in known devices, correctly interprets the code whether it is read in the correct direction or in the opposite direction.

Fig. 4 shows a reading head element for a head with only one set of fibres. Here the code to be read is illuminated by ambient light as indicated at 20, with a single set of fibres such as 21 to convey the reading pattern to the associated electronics.

Fig. 5 shows another alternative to the use of optical fibres to supply the light. Here the head includes a linear lamp 22 to illuminate the bar code. This is only suitable for reading from a flat surface.

Fig. 6 shows a reading head 25, which is of flexible material so that it can be bent to a read bar code 26 from a cylindrical outer surface of a can or bottle 27.

Such a code reading method does not damage the code surface, as can happen with a moving parts reader. This is important when reading codes printed in a catalogue or a telephone number in a directory since it does not reduce the useful life of the book. Another advantage of a static reader is that reading is unaffected by the user's speed of movement of a probe, the reading speed being dependent on the scanning characteristics of the CCD circuitry.

If the reading head is of transparent material, it is easy for the user to see that he has correctly positioned it over the printed code before reading takes place. Thus if printed bar codes are on

adjacent lines, as in a telephone directory it is easy to correctly position it over the wanted line. Hence it will be seen that the present static readers are well suited to auto dealing of

5 telephone calls.  
An "auto-dial" reading head is shown in Fig. 7. This has an end portion 30 which is a transparent moulding made in cylindrical lens form so that when placed over a telephone directory as in Fig. 8 a broadened image of the verbal portion of the entry is obtained, the read head proper 31 being then over the bar code 32. The press-to-read push-button is shown at 33: when this is operated the wanted number's bar code is read, and the electrical representation thereof sent to an auto-dialler (not shown).

#### Claims

1. An optical bar code reader, which includes a reading head housing an array of optical fibres whose ends are in a linear array which when in use is placed adjacent to and aligned with the length of a bar code to be read, electronic devices each responsive to light reflected from the bar code being read, and a scanning circuit associated with said electronic devices and adapted when energized to cause the conditions of said electronic devices, and thus the bar code with which the fibre ends are aligned, to be read.

2. A code reader as claimed in claim 1, in which light is supplied to the code to be read by the ambient light.

3. A code reader as claimed in claim 1, in which the reading head includes a second set of optical fibres whose ends terminate adjacent to the ends of the first-mentioned set of optical fibres and which supply light to the code to be read from an artificial light source.

4. A code reader as claimed in claim 1, in which the reading head includes a linear electric lamp so mounted as to shine light on a bar code to be read.

5. A code reader as claimed in claim 1, 2, 3 or 4, in which the reading head is of transparent material.

6. A code reader as claimed in claim 1, 2, 3, 4, and 5, in which the reading head is of flexible material, to facilitate reading from a curved surface.

7. A code reader as claimed in claim 6 and which has an extension portion aligned with the reading head and of transparent material so as to

facilitate the use of the reader for reading a bar code aligned with a line of print, said extension portion being of cylindrical lens portion.

8. A code reader as claimed in any one of the preceding claims and in which the electronic devices which respond to the light pattern from a code to be read are charge-coupled devices.

9. An optical bar code reader, substantially as described with reference to Fig. 1, 2, 3, 4, 5, or 6 and 7 of the accompanying drawings.

New claims or amendments to claims filed on 1st July 1982

#### New or amended claims:—

10. A static optical bar code reader, which includes a reading head having an array of optical fibres whose ends are in a linear array, which reading head when in use is placed closely adjacent to and in alignment with the length of a bar code to be read, the head being maintained stationary during the reading, electronic devices responsive to light reflected into the fibre ends from the bar code to be read, and a scanning circuit associated with the electronic devices and adapted, when energized, to cause the conditions of the electronic devices, and thus the bar code, to be read, the arrangement being such that a said bar code can be read without relative movement between the bar code and the reading head.

11. A method of reading a bar code optically which includes placing a reading head adjacent to, in engagement with, and in alignment with, the bar code to be read, which head has an array of optical fibres in a linear array and aligned with the length of a bar code when the reader is correctly located with respect to that bar code, wherein the head is maintained stationary during the reading, wherein light reflected into the fibre ends during the reading is applied to and sensed by a number of electronic devices which are thus responsive to the bar code, and wherein after the head is correctly located with respect to the bar code to be read a scanning circuit associated with the electronic devices is enabled, which scanning circuit causes the conditions of the electronic devices, and hence the bar code with which the head is aligned, to be read, the method and the head being such that a said bar code is read without relative movement between the head and the bar code.

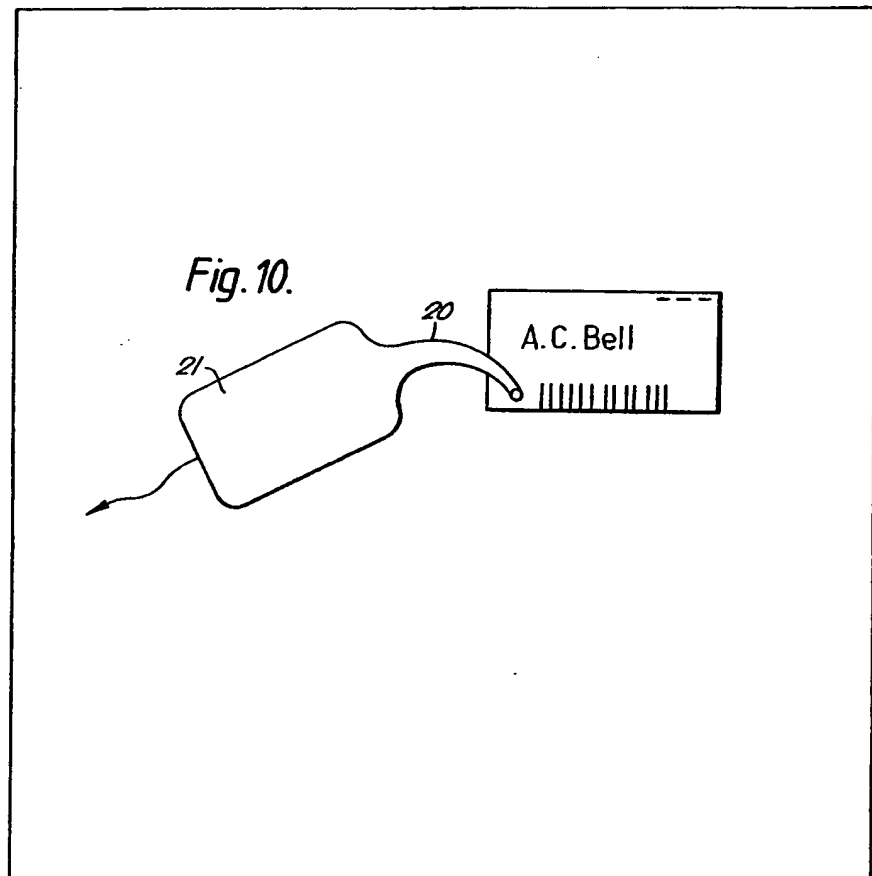
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GB 1290953  
GB 1244215  
GB 1075452  
GB 989112  
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(54) Digital transmission for telephone use

(57) In a telephone subscriber's instrument, dialling of a wanted number uses a mark-sensing technique in which relative movement occurs between the wanted number represented in bar code form and a sensor.

In a preferred form, the sensing is effected by moving a hand-held probe (20) across the bar code on a card, or telephone directory entry or other printed record. The code as read by the probe (20) is converted to electrical form by circuitry in a box (21) associated with the probe.



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Fig. 1.

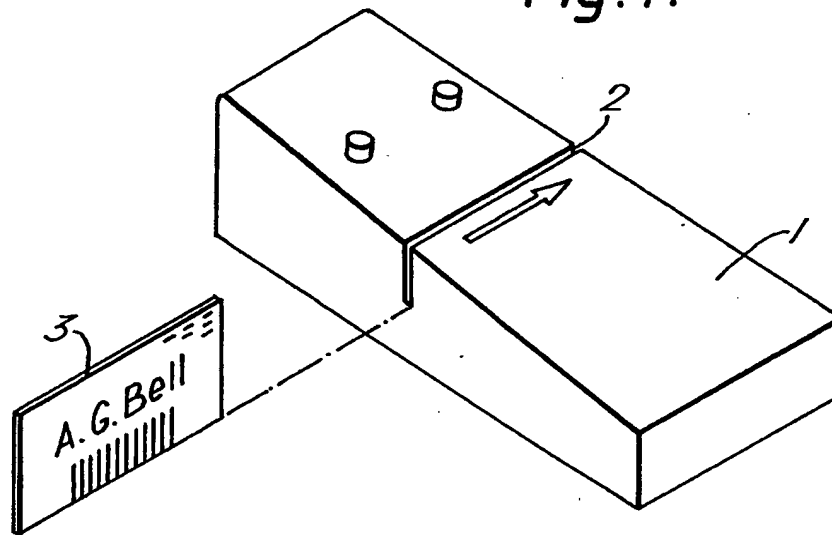


Fig. 2.

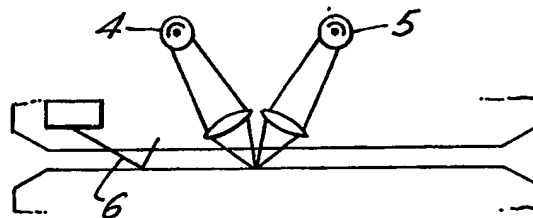


Fig. 3.

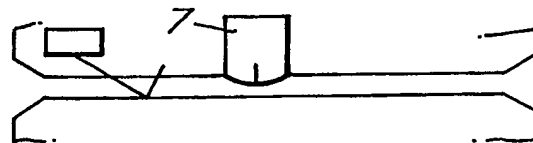
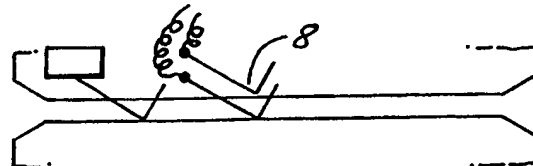


Fig. 4.





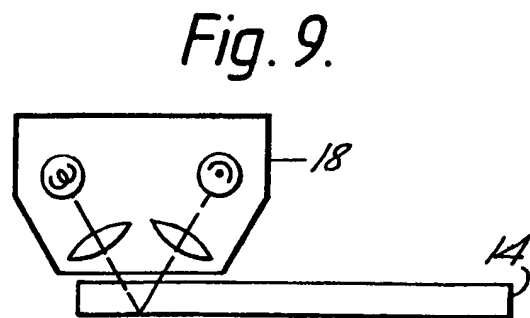
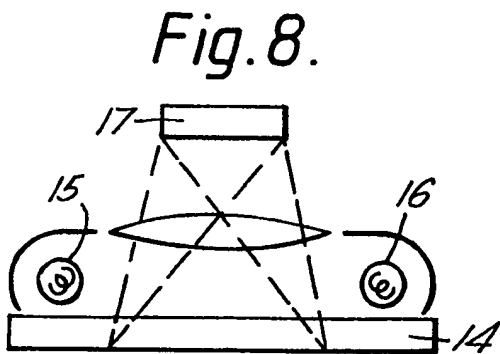
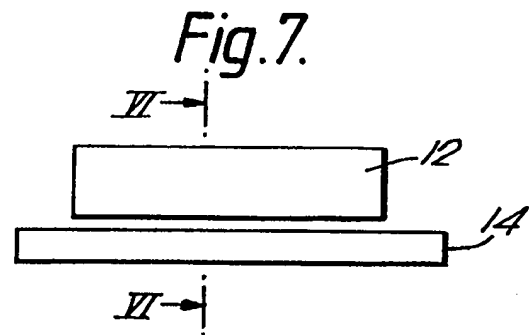
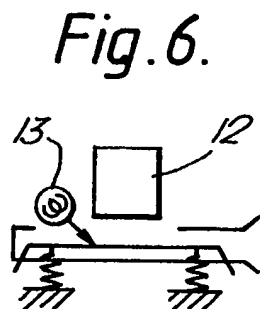
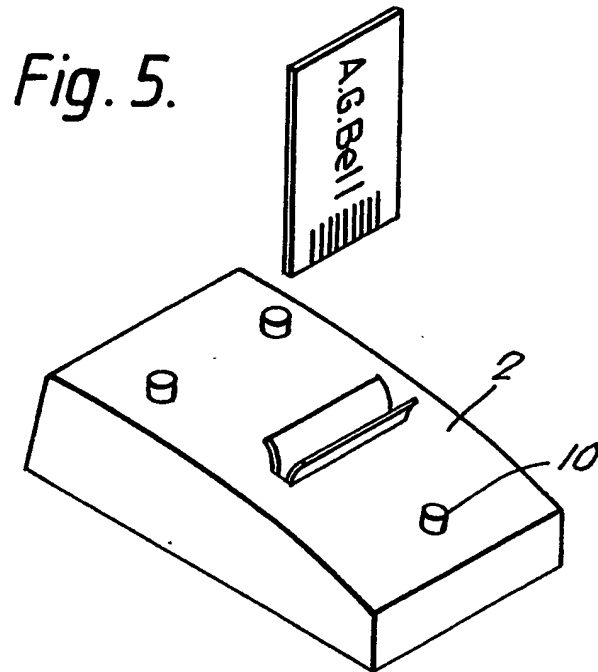


Fig. 10.

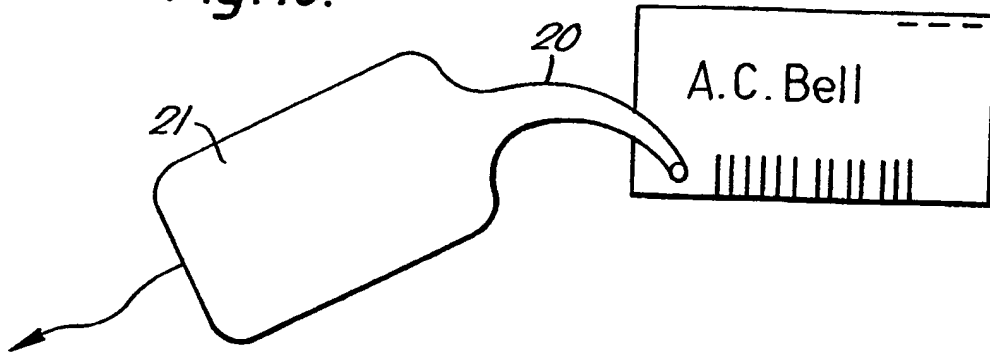


Fig. 11.

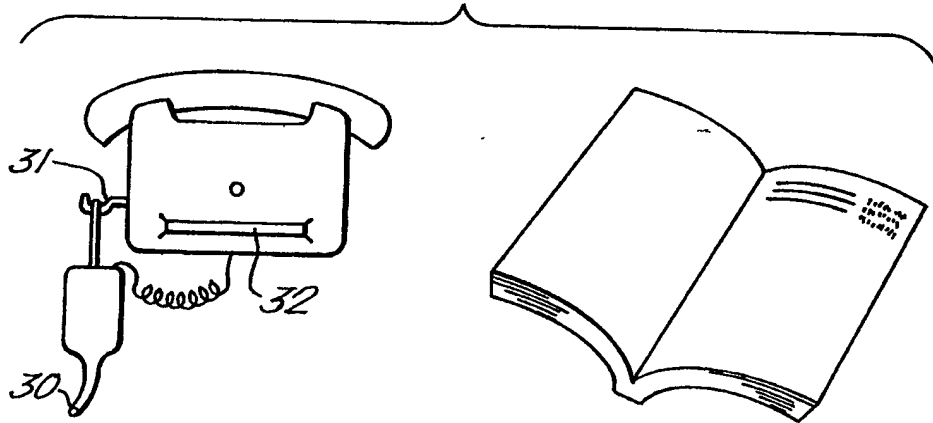
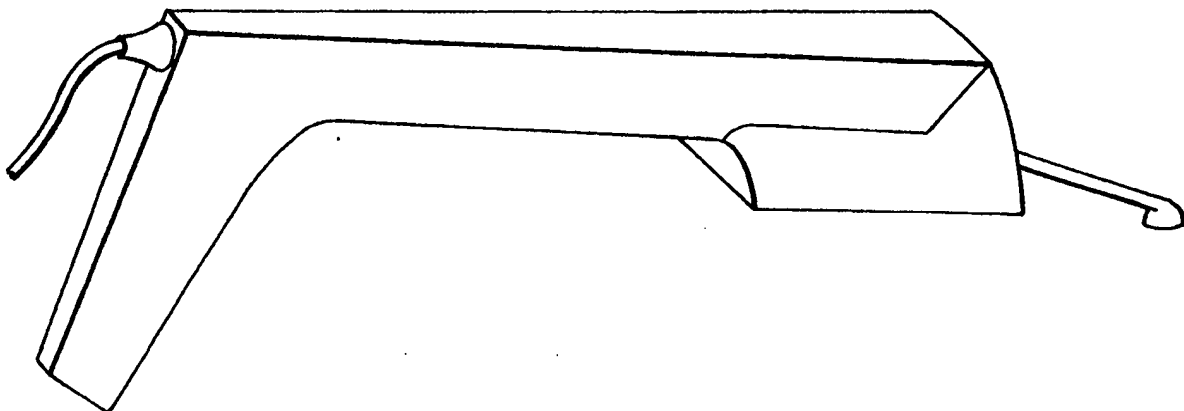


Fig. 12.



## SPECIFICATION

### Digital transmission for telephone use

5 This invention relates to methods of, and apparatus for, the transmission of wanted-number digits from a telephone subscriber's instrument.

Such digit transmission is usually known as dialling in spite of the fact that many telephone  
10 instruments now in use employ push-button sets for the digits transmission. Dials and push-button sets are relatively complex mechanisms, and it is an object of this invention to provide a similar and more economical method of digit sending than that used  
15 hitherto.

According to the invention there is provided a method of transmitting a wanted number from a telephone subscribers's instrument or the like, in which the number is printed or otherwise represented in a mark-space coded form on a suitable  
20 surface, and in which to transmit the number relative movement is produced between the coded representation of the number and a sensing device, such that the sensing device senses the mark-spaced coded representations and derives therefrom an electrical  
25 output which forms the wanted number output of the instrument.

The coded representations mentioned above are printed telephone directories in association with the name and address entries, probably immediately  
30 adjacent to the printed telephone number. In addition the coding can be printed on headed notepaper, in advertisements in the press, and along the edge of a card such as a visiting card. In the latter case, as  
35 will be seen below, the card is fitted into a slot in the body of a telephone instrument and moved laterally along the slot.

Embodiments of the invention will now be described with reference to the accompanying drawings, in which:-

*Figure 1* shows schematically an embodiment of the invention in which a card bearing the wanted number in coded form is moved along a slot in the telephone instrument body.

*Figures 2, 3 and 4* show schematically three mark sensing techniques for use in the arrangement of *Figure 1*.

*Figure 5* is an alternative arrangement to that of *Figure 1* for sensing a number coded along a card.

*Figure 6, 7 8 and 9* represent various sensing techniques usable with the arrangement of *Figure 5*.

*Figure 10* shows an embodiment of the invention in which the mark sensing uses a hand-held probe.

*Figure 11* shows schematically how the embodiment of the invention shown in *Figure 10* may be applied in a telephone call box.

*Figure 12* shows how a probe for use in an arrangement such as that shown in *Figure 10* may be incorporated into a telephone handset.

60 In *Figure 1*, there is a telephone instrument body 1 housing a slot 2 into which a card 3 is fitted when a number is to be "dialed". This case bears a coded representation, in mark-space form - of the number to which the card relates along its lower edge. This  
65 card is fitted into the left-hand end of the slot after

the caller hears dial tone, and then moved along the slot in the direction of the arrow on the instrument body 1. This arrow is printed on the upper surface of the body 1, as guidance for the subscriber. As the  
70 card moves along the slot, the coded number on its lower edge is read off by the sensing means, so that it can be sent to the exchange, for instance by "Strowger-type" impulsing a voice frequency.

One form of sensing device is shown in *Figure 2*:  
75 here we have a lamp 4 from which light is directed on to the path of the card via a lens, reflected light being directed by another lens on to a photo-cell 5. At the end of the slot there is a start-stop switch 6, which is switched on by the front edge of the card as  
80 it is fitted in and switched off by the rear edge of the card towards the end of its travel along the slot.

In *Figure 3*, the sensing device is a magnetic read head, the coded representations of the number using ferro-magnetic strips. In the arrangement of  
85 *Figure 4*, the marks on the card are of electrically conductive material, and sensing uses a pair of contacts 8 which bear on the card as it traverses the slot. For each conductive strip sensed, current flows between the two contacts 8.

90 In the above arrangements, the slot may be provided with ratchet rollers or ratchet-type surfaces to prevent movement of the card backwards.

In the arrangement of *Figure 5*, the card has its coded on one of the shorter edges, and after it has  
95 been fitted into the slot 2 a send button 10 is depressed, which causes sensing means to scan along the card edge and thus read off the number. It will be appreciated that operationally this is the inverse of the arrangement of *Figure 1*.

100 Various scanning arrangements can be used: thus in *Figures 6 and 7*, where *Figure 6* is a section along the line VI-VI of *Figure 7*, the detection uses a charge coupled device arrangement 12, with a lamp 13 whose light output is "aimed" at the card while in  
105 the slot 14. The scanning is effected by circuitry in the arrangement 12.

*Figure 8* shows an arrangement in which there are two lamps 15 and 16, each with its own reflector, and a charge coupled device circuit 17 on which light  
110 reflected from the card in the slot 14 is received.

*Figure 9* uses a mechanically movable optical scanning head 18.

Another method of reading the code combinations uses a hand-held probe, see *Figure 10*. Here the  
115 probe 20 is wiped along or closely adjacent to the coded representation of the number. Reading can use optical techniques with the associated circuitry in the probe's box 21. Such a device can be used to read cards such as used in the arrangements of  
120 *Figures 1 and 5*, and also coded representations in telephone directories or included in a company or person's headed notepaper, or in advertisements. Such a probe could read the code optically, electrically or magnetically.

125 *Figure 11* shows schematically an arrangement for a public call box using the probe technique. Here we have a probe 30 with its box hanging from a hook 31 on the telephone casing. At the back of this instrument there is a slot 32 for reception of a credit card.  
130 As shown, the telephone directories can include,

alongside each number its coded equivalent. Reading via the probe enables the user, if so desired to ignore part of the noted number, e.g. the 01 prefix for a local call when dialled within the London

5 telephone region. A telephone directory is shown at the right-hand side of Figure 11, with the coded representation shown at the right hand end of each subscriber's line on the page.

Such a probe could be incorporated into the handset, as shown in Figure 12. It could be retractable and operable like a flick knife, or hingeable like a penknife blade. The handset in such an arrangement is held in the usual way until dial tone is heard, when the probe is wiped across the bar code, after which the handset is returned to the ear. Such a handset could be so designed as to have an end suitably-shaped to contain a fixed probe at its end.

For optical reading of the coded representation the lamp used should be of the low current type to minimise drain on the line current. A light-emitting diode is a good choice if it provides enough light.

Several methods could be used to print the coding, for instance:

a) optically-read black and white bars, e.g. with different spacing and or thickness, which could be printed by a special typewriter head.

b) Magnetically-read bars, printed, as in (a), above.

c) Magnetically-read magnetic recording on the page, preferably invisible or appearing as a colour wash over the printed name and address.

d) Magnetically printed figures such as CMC7 or E13B characters as used on cheques. These may need to be reduced in size without impairment of efficiency.

e) Optically read printed figures, i.e. the telephone number as now printed.

f) Optically read coloured bars over each printed address.

With telephone directories, especially in the London area, resistance may be encountered to increasing the space allocated to each entry. Thus alternative (f) may be used, with, for instance, a yellow bar code which would not impede reading of the address by the eye, but is easily readable by a probe sensitive only to yellow marks.

Other convenient places for bar coding are:

i) in all advertisements in newspapers and journals in which an instant call is invited.

ii) on the telephone itself for emergency numbers such as 999.

iii) on a special pad by the telephone.

iv) on notepaper and billheads.

We have referred above to circuitry needed to convert the codes read by the sensing device into signals for transmission to a telephone exchange. Such circuitry includes a store into which the bar code signals read by the sensing device are placed plus conversion circuits to convert the stored signals digit-by-digit into either break impulses or voice frequency signals for transmission to the exchange. Where the conversion is to break impulses such as used in "Strowger-type" exchanges the circuitry can, for instance, follow the principles of our Patent No. 1,369,829 (M.J. Debenham-1) or of our Patent

No. 1,395,577 (A.N. Lawson-C.M. Tabalba 10-5).

## CLAIMS

1. A method of transmitting a wanted number from a telephone subscriber's instrument or the like, in which the number is printed or otherwise represented in a mark-space coded form on a suitable surface, and in which to transmit the number relative movement is produced between the coded representation of the number and a sensing device, such that the sensing device senses the mark-spaced coded representations and derives therefrom an electrical output which forms the wanted number output of the instrument.

2. A method as claimed in claim 1, in which the number is represented along the edge of a card or the like which is moved manually through a slot in the instrument body, the card being progressed past the sensing device.

3. A method as claimed in claim 1, in which the number is represented along the edge of a card or the like, which is fitted into a slot in the instrument body, and in which the sensing device is then moved along the card or the like to effect said sensing.

4. A method as claimed in claim 1, 2 or 3 and in which the sensing device is an optical sensor.

5. A method as claimed in claim 2 or 3, and in which the sensing device is a magnetic sensor.

6. A method as claimed in claim 2 or 3, in which the coded representations are electrically conductive strips on the card, and in which the sensing device includes a pair of contacts bearing on the card such that for each said strip an electrical connection is set up between the contacts via that strip.

7. A method as claimed in claim 1, and in which the sensing device is a hand-held probe which is traversed manually along the line of the coded representation.

8. A method as claimed in claim 7, in which the sensing device is an optical sensor.

9. A method as claimed in claim 7, in which the sensing device is a magnetic sensor.

10. A method as claimed in claim 7, 8 or 9, and in which the probe is integral with or carried by the telephone handset.

11. Apparatus for performing the method of any one of claims 1 to 10.

New claims or amendments to claims filed on 27 Oct. 1980.

New or amended claims:-

12. A hand-held probe for transmitting electrical signals representative of a wanted subscriber's number from a telephone subscriber's instrument, which probe includes a sensing device such that when the probe is traversed across a mark-space coded representation of the wanted number printed or otherwise produced on a suitable surface electrical signals representative of the wanted number are produced by the sensing device, and electrical circuitry in the probe and associated with the sensor,

which circuitry derives from the output of the sensor electrical signals representative of the wanted number for transmission from the instrument.

13. A probe as claimed in claim 12, and which is an item separate from a telephone instrument's handset but which is connected to the instrument by a cable.

14. A probe as claimed in claim 12, and which is part of the telephone instrument's handset.

15. A probe as claimed in claim 14, and which probe is normally housed within the handset, but is extensible therefrom when a wanted number is to be transmitted.

16. A probe as claimed in claim 12, 13, 14 or 15, and in which the sensing device is an optical sensor.

17. A probe as claimed in claim 12, 13, 14 or 15, and in which the sensing device is a magnetic sensor.

18. A method of transmitting a wanted number from a telephone subscriber's instrument, in which the number is printed or other-wise represented in a mark-space coded form on a suitable surface, and in which to transmit the number a hand-held probe which contains a sensing device is traversed across the said representation of the wanted number, whereby electrical signals representative of the wanted number are produced by the sensing device, and in which electrical circuitry in the probe and associated with the sensing device responds to the result of the sensing of the mark-space coded representation and derives therefrom an electrical output which forms the wanted number output of the instrument.